THE DEVELOPMENT OF A PATIENT CLASSIFICATION SYSTEM FOR MEDICAL/SURGICAL PATIENTS IN AN ACUTE CARE SETTING

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THESIS

THE DEVELOPMENT OF A PATIENT CLASSIFICATION SYSTEM FOR MEDICAL/SURGICAL PATIENTS IN AN ACUTE CARE SETTING

by

Mary Anne Gardner

June 1979

Thesis Advisor: L. J. Cavaiola

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This study was undertaken in an attempt to identify a flexible patient classification system that could be used with confidence as a tool to assist in the determination of nursing care workload. A patient classification system in use at one Naval Regional Medical Center was revised and tested at another naval facility Indicators of patient dependence on nursing care were identified and four methods were used to determine indicator weights and

patient classification. The results of each method were evaluated in comparison with consensus nursing judgment and determined to be essentially equivalent.

The Development of a Patient Classification System for Medical/Surgical Patients in an Acute Care Setting

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This study was undertaken in an attempt to identify a flexible patient classification system that could be used with confidence as a tool to assist in the determination of nursing care workload. A patient classification system in use at one Naval Regional Medical Center was revised and tested at another naval facility. Indicators of patient dependence on nursing care were identified and four methods were used to determine indicator weights and patient classification. The results of each method were evaluated in comparison with consensus nursing judgment and determined to be essentially equivalent.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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I. INTRODUCTION

A. NURSING PERSONNEL STAFFING

Health care costs, fueled by such factors as modern medical technology, advanced specialized training, and sophisticated equipment, have risen steadily and rapidly over the past 15 years. It has been estimated that in 1979 the United States will spent 9.1% of its GNP on health care [Ref. 18]. Manpower required to staff health care facilities is claiming its share of the dollars. With up to 25 or 30 percent of a hospital's budget spent on personnel, nursing service claims 60 to 75 percent of that amount [Refs. 14 and 28].

Current cost control measures, utilization review committees and impending hospital cost containment legislation are exerting pressures on health care facilities to justify their personnel requirements, forcing health care administrators to utilize their resources more effectively and efficiently. And nurses, besides being more expensive, are no longer plentiful.

A shortage of nurses was beginning to be of concern as long ago as 1955 [Ref. 7]. Today, hospitals are experiencing a crisis in recruiting and retaining registered nurses [Ref. 10]. But the current scarcity of RN's is only one of several factors forcing health care administrators to attempt to find a solution to the classic economic question: how to utilize scarce resources most effectively.

What determines how many nursing personnel are needed? How should a hospital be staffed? How many nurses are enough? How many support personnel are required? Where and how should they be assigned? What kind and quality of care should they give? In short, what staffing methodology should be employed?

Until relatively recent times, nursing personnel staffing was based on experience, judgment, precedent, or traditional staff/patient ratios [Ref. 2]. But in today's increasingly sophisticated scientific world of computer-based management and analytical decision making, nursing administrators are being required to support their demands for staff with more objective methods [Ref. 8]. Judgment, experience, and "gut feel" must be translated into readily understandable methodology, justifiable and explainable to governing boards, hospital administrators, government agencies, and organizations such as the Joint Commission on Accreditation of Hospitals.

This pressure has focused attention on attempts to formulate some methodology that will identify the work to be done -- some way to measure the workload of the nursing staff. These attempts to measure that workload have been the impetus for the development and utilization of patient classification systems.

B. PATIENT CLASSIFICATION SYSTEMS

A patient classification system is a tool designed specifically for nursing. It includes a set of rules or

criteria used to identify patients according to their nursing care requirements and divide them into relatively homogeneous categories based on those requirements [Refs. 14 and 23].

The use of patient classification systems constitutes an attempt to include in determination of nursing workload factors other than patient census alone, which ignores the difficult-to-predict and variable nature of demands for nursing care [Refs. 15, 21 and 35]. A high patient turn-over rate or sudden drastic changes in patients' conditions can cause rapid and extreme fluctuations in demand for care, albeit a stable census is maintained. Patient classification systems developed in response to the need for some method of measurement more rational and more sensitive to this fluctuating demand than patient census or percent occupancy [Ref. 17].

There are many patient classification systems in use today and unknown numbers in various stages of development. It is estimated that more than 1,000 hospitals are presently using some form of patient classification system [Ref. 15]. Although use of such a system is not, nor is it meant to be, the definitive answer to a facility's staffing problems, it presents a logical and rational approach to begin to deal effectively with those problems.

C. OVERVIEW

This paper will focus primarily on the development of a patient classification system. Characteristics of patient classification systems in general will be discussed, followed

by a review of the literature. The methodology used in the development and refinement of one system will be reviewed, followed by an analysis of the findings. Conclusions of the study will be presented, as will recommendations for future research and utilization.

It is cautioned that the use of patient classification systems constitutes only a small part of any attempt to develop a functional staffing methodology. Aydelotte claims that any effective staffing program includes four elements:

1. Identification of the quality of the product to be rendered to the client;

2. Prediction of the number and kind of personnel needed to produce the volume and quality of nursing care required;

3. Selection and arrangement of the nursing staff in specific configurations and the development of assignment patterns for the staff required 24 hours per day, seven days per week;

4. Evaluation of the effectiveness of the staff's product (nursing care) upon the patient population to whom it is rendered. [Ref. 3].

Development of a patient classification system is only a partial response to the second element and is thus far from the total solution to any staffing problem.

The importance of the interaction of these elements is echoed in the report of a Navy staffing study that further emphasizes an approach to staffing that simultaneously includes evaluation of overall manpower requirements, allocation of resources, and short-term scheduling [Ref. 24].

With the above caveats in mind, this study is further limited by its emphasis on medical/surgical patients.

Medical/surgical patients were chosen because, in a general hospital, they constitute the largest proportion of hospitalizations. Their needs and requirements as identified in a patient classification instrument are generally easily adaptable to those of patients in most other services. An additional limitation, that of concern with only the acute care setting, is recognized although work in other areas will be addressed briefly.

As with any composite methodology, the eventual worth of the final product is dependent upon the worth and validity of its component parts. This concern constitutes the driving force behind the development of a reliable, flexible, accurate, easy-to-use patient classification system.

II. PATIENT CLASSIFICATION

Patients may be classified in a number of ways, according to a variety of criteria -- age, sex, medical diagnosis, length of hospital stay, etc. Patient classification in nursing today is much more specific and refers to the identification and categorization of patients according to some measure of their demands for nursing care. The specific approach to classification varies among different instruments. Patients may be categorized according to "self-sufficiency," "requirements for nursing care," or "need for nursing care." Whatever the approach, the main objective is to separate patients (physically or not) by their demand for nursing care. Unless patients are hospitalized on relatively homogeneous units (e.g., self-care units), this demand may be highly variable and independent of patient census.

A. HISTORY

Some of the early attempts at patient classification grew out of a need to provide adequate staff, to identify appropriate staffing assignments, or to reconcile requirements of patients with available physical resources. Results met with varying degrees of success. The instruments used were frequently very subjective and the categories were not always defined so as to be mutually exclusive. Measurement techniques were often inexact and underlying assumptions inappropriate.

Beginning in the late 1940's and continuing throughout the 1950's, the concept of patient classification was strengthened and instruments refined and clarified.

Not until 1960, however, did patient classification systems become the subject of widespread interest and study. It was in that year that Connor produced his now-classic study of patient classification and staffing [Ref. 9]. With a combination of industrial engineering techniques and identification of specific elements of a patient's condition which were indicative of his requirements for care, Connor was able to determine an estimate of nursing time required. The instruments and techniques of this study, which will be described in greater detail in Chapter III, are still widely used today and form the basis for many of the more recently developed classification systems.

B. USES·

The selection of the classification system to be used in any facility is highly contingent upon the needs of the particular facility. Although many hospitals rely on a patient classification system primarily as an integral component of a staffing methodology, its use in related areas is becoming more widespread.

Assignment of nursing personnel may be improved using a classification system. In an acute care setting, more experienced and highly trained personnel may be assigned to those patients requiring more skilled and greater amounts of

nursing care. From a teaching aspect, students may be assigned care of patients in more care-demanding categories as their skills and organizational abilities increase. A recent study by the Visiting Nurse Association of Cleveland has shown promising results when caseloads of public health nurses are based on the family's or patient's classification [Ref. 29]. Information from classification systems can assist in adjusting assignments to reflect a more equitable distribution of work among personnel.

Some hospitals have altered admission policies based on information from classification systems. Decisions to admit patients to a hospital or to a particular unit are based not only on available bed space but also on the care requirements of patients already hospitalized, the projected demands of the prospective patient, and the available staff [Ref. 26].

Taking an even more system-wide approach, Sjoberg explains how patient classification systems have been used in the development of a new concept of ward organization called unit assignment. Guided by patient classification, this system incorporates principles of patient care assignment and physical plan and design to achieve efficient delivery of nursing care closely matched to patients' needs [Ref. 31].

Several health care facilities rely on patient classification systems to identify nursing care requirements and thus provide a basis for a more equitable method of charging for hospitalization [Ref. 19]. The patient pays only for the care he receives. Viewing nursing service as a cost

center, generation of actual costs annd their subsequent charges are more readily identified and more easily controlled.

Several uses of patient classification systems have been presented. As research continues in this area, more uses will be identified, tested and implemented. Giovannetti emphasizes that whatever system is used, and for whatever purpose, its success depends on understanding and acceptance by all members of the health care team.

> Understanding involves awareness and knowledge of classification system capabilities with recognition that: (1) they are based on a unidimensional and partial assessment of patient requirements for care; (2) quantification is primarily based on the existing practice of nursing; and (3) their value is enhanced by adequate measures of reliability and validity [Ref. 15, p. 8].

C. CATEGORIES

The number of categories into which patients are divided varies with the instrument used. They may number from three, as in Connor's work [Ref. 9], to as many as nine. Some methodologies attempt to determine the patient's need for nursing care and transfer that measure directly to a staffing model without attempting to classify patients into homogeneous groups. This system theoretically allows for as many groups as there are patients [Ref. 24].

Most of the commonly used formats today rely on three or four categories, identified by such titles as "minimum care," "average care," "above average care," "complete care;" or "self care," "partial care," "total care;" or simply "I,"

"II," "III." Whatever descriptors are used, no attempt is made to claim that all patients within one category are the same or have the same needs. It is assumed, however, that the nursing care required by patients within a particular category or class is more similar (with regard to amount, time or difficulty) than nursing care required by other classes.

D. DECISION CRITERIA

Abdellah and Levine describe two basic types of patient classification systems -- "prototype evaluation" and "factor evaluation" [Ref. 1]. The distinctions between these two types are the criteria or decision rules employed in assigning membership to a specific category.

The "prototype evaluation" is basically a judgmental decision based on comparisons of written descriptions and examples of typical patients who would be included in each category, resulting in assignment to that category which comes closest to describing the actual patient.

The "factor evaluation" format identifies various elements or characteristics of nursing care. The patient is then scored or rated on these elements (present or absent, or present to a certain degree). These scores, when combined, are then used to determine to which class the patient is assigned. The "factor evaluation" system is by far the more common today and describes a variety of systems presently in use.

E. ASSOCIATED MEASUREMENTS

Most patient classification systems are used in conjunction with some quantitative measurement. This is especially true if the classification system in use is a component of a specific staffing methodology. For this reason, staffing methodologies will be addressed briefly although the primary focus of this paper is patient classification systems.

To provide greater accuracy in the determination and allocation of resources, more information than merely the number of patients in each class is needed. This is so whether the additional information is provided by quantitative measurements or solely by the judgment of nursing supervisors.

Many classification systems rely on average time or standard time measurements. With the use of industrial engineering techniques such as work sampling and continuous observation, average time required to deliver nursing care to a specific category of patient can be determined. This quantitative measurement, which constituted the basis of Connor's work [Ref. 9], gives nursing administration very specific information to use in staffing decisions and justification of resources. Although the use of industrial engineering techniques has been considered a major breakthrough in classification and staffing methodology, this has not been achieved without disadvantages.

The caveat that time measurements are facility-specific is repeated in many studies and reports [Refs. 4, 20 and 27].

Actual times required at each facility will vary depending upon the quality and quantity of personnel available, what mix of various personnel is employed, actual physical design of work areas, degree of support provided from other areas of the hospital, acceptable standards of care, and specific responsibilities of nursing service. These factors, along with nursing service and hospital policies and procedures, combine to severely limit or restrict "portability" of patient classification systems.

Time measurement itself has been the subject of much criticism by registered nurses. Many nurses have difficulty accepting accuracy, or even existence, of such calculations as average time or standard time. Their main disagreement lies in the fact that these aggregate measures ignore the individuality and unique needs of the patient as well as capabilities and expertise of the nursing staff. The fact that these measurements vary so widely from facility to facility and even unit to unit within one facility may lend credence to this argument.

A third factor of concern is that times are determined on the basis of nursing care as it exists at the time of measurement, not necessarily as it should be. This carries the implicit assumption that the work being done is at least adequate and therefore appropriate to use as a basis for future staffing.

Expense involved in the collection of data must also be considered. To avoid this expense, hospitals may use data

from a similar facility and adjust those numbers over time to meet their needs.

A staffing methodology recently developed by Norby, Freund and Wagner ignores time measurement, focusing instead of "degree of difficulty" of assignments [Ref. 25]. Difficulty of nursing activities is scaled for various categories of nursing personnel, and assignments are made based on this determination and related data. While this measurement may be more acceptable to nursing personnel, it shares the problem of being facility- or unit-specific.

Although patient classification systems have been shown to be very helpful in staffing decisions when used in conjunction with quantitative measurements, those facilities lacking resources or expertise to determine appropriate measurements may still use classification systems profitably. No system has been developed with the purpose of being the final determining factor for optimal staffing, assignments or planning. The systems are tools, to be used with other information, to assist in the determination of requirements and allocation of resources. Even without a set of valid measurements (average or standard times per procedure or for each class or category of patients) patient classification systems can still serve as a useful adjunct to the staffing process. Additional information about present or anticipated demand for nursing care (as signified by an increased number of Category III patients, for example) can be employed by a nursing supervisor when making decisions concerning staffing assignments.

F. SELECTION OF INDICATORS

Patient classification systems that are of the "factor evaluation" design identify specific elements of nursing care (e.g., bathing, feeding, medicating) or indicators which are intended to represent possible patient conditions. The choice of indicators to use for any instrument is influenced by a number of variables. The first of these is the type of patient with which it is intended to be used -- medical/surgical, obstetric, pediatric, psychiatric, etc. Although some indicators may be common to all, each service may have its own unique requirements for care.

Secondly, the type of facility is important. Indicators that may be descriptive of acute-care patients may be inappropriate for use with long-term care or public health care patients. The organization of the facility must be considered. For example, if nursing service were responsible for providing respiratory therapy services, "respiratory therapy" may be an appropriate indicator to use in assessing demand for patient care. If, however, a respiratory therapy department existed and technicians were responsible for providing that care, such an indicator may not be helpful in determining demand.

Available quantitative measurements may be another factor in choosing indicators. If a task analysis approach were used, a complete list of tasks would be compiled and, using standard times (or a related point system), the total time required for

each patient could be determined by summing the times for each procedure or "task" that patient is to receive.

If average times required by class of patient were available, then choosing a set of indicators sensitive enough to separate patients by class would be more appropriate.

Whatever the specific system, the indicators chosen are usually those which include information about a patient's ability to perform the activities of daily living (eating, bathing, elimination, mobility) [Ref. 28]. Special procedures, treatments and observations are usually included also [Ref. 14]. Some instruments include specific information about special instructional or emotional needs that the patient may have while others direct that requirements in these areas be included under other indicators. For example, a patient may be physically capable of bathing himself but is extremely anxious and distraught over his hospitalization; assisting him with his bath affords the nurse the opportunity to provide emotional support. With one instrument, this demand for care may be reflected by including an indicator such as "needs minor emotional support" while in another system "needs assistance with bathing" would describe the requirement.

Emphasis has been placed on "factor evaluation" type systems primarily because the majority of systems in use today can be described in this manner. Although "prototype evaluation" design has been studied and implemented successfully [Ref. 11], it is often viewed as subjective and therefore considered not as accurate as the quantitative "objective"

approach of the factor design. While it is true that the former is based on subjective decisions, the same is true, to a degree, of the latter. The actual choosing of the indicators to use depends on subjective decision making, and the scores or weights used with those indicators are frequently determined in like manner.

Indicators are chosen not necessarily to be all-inclusive, but to represent, out of all possible indicators, those which possess the greatest ability to identify and segregate patients into appropriate categories. These indicators may be selected by polling professional nurses or may be adapted from other instruments to coincide with conditions at a specific facility.

Usually some revisions are made as the instrument is tested and refined, but little has been reported in the area of subset selection. If use of 35 indicators has produced acceptable results, is it possible to obtain results of at least similar quality with fewer indicators? Cavaiola has obtained good results with a subset of 12 out of 37 original indicators in his study of staffing for long-term care [Ref. 5], but other studies are scarce.

It is theoretically possible to classify patients into three or four categories using as few as four indicators, but acceptance of the instrument may suffer. The trade-offs among ease of use, accuracy and acceptance by users must be considered by each facility before implementing a classification system.

G. WEIGHTING OF INDICATORS

Once indicators are chosen for a patient classification system instrument, one of two methodologies is usually employed to determine the appropriate category for each patient. In systems modeled after Connor's [Ref. 9], indicators are checked if present or applicable for each patient, and then, using a series of decision rules, the patients are divided into various categories. For example, if indicators 2, 3 and 4 apply, but 1 and 5 do not, the patient would be in Category II. If 3, 4 and 5 apply, but 1 and 2 do not, he would be in Category 1.

The basic assumption underlying any choice of indicators is that, even though all the indicators represent demand for nursing care, they do not necessarily indicate equal amounts of nursing care. For this reason, some systems assign weights to the various indicators in an attempt to quantify degrees of nursing care. For example, a patient may require frequent dressing changes throughout a shift but need little assistance ambulating. The dressing changes represent a greater demand on the time and effort of the staff than the minor assistance ambulating. This is indicated by assigning a heavier weight to the former.

Once lists of the desired indicators and their weights are determined, those indicators that describe a specific patient are selected, and the weights assigned to these indicators are summed, resulting in a point score for each patient. Point boundaries are determined for each category,

and the patient is classified by comparing his total point score to these boundaries.

Information regarding techniques used in determination of indicator weights is somewhat sketchy and often vague. As part of a staffing methodology, Norby et al. developed a patient classification system consisting of 32 indicators [Ref. 25]. Weights for these indicators and point boundaries for categories were determined, "through a process of statistical regression and validation," over a period of several months [Ref. 25, p. 5]. Procedures based on Q-sort techniques are recommended in that study for adapting original weights to the needs of another facility.

Several studies use scales associated with time or ranges of time required for procedures, to arrive at a direct-care workload index [Refs. 6 and 26].

Another procedure employed is to rate each indicator on a three- or four-point scale, signifying the relative amount of nursing care required by each patient for each indicator. These numbers are then summed and the point total compared against established boundaries. Some instruments do not sum these point values but use other decision rules to determine the appropriate category [Ref. 17].

Other strategies for calculating weights are used, including consensus opinion of unit nurses and supervisors.

Mathematical techniques of varying degrees of sophistication may also be used. Average rank/ordinal weight, forced normal distribution and normal z-score, all based on

Q-sort procedures, are three methods for calculating indicator weights [Ref. 23]. Additionally, statistically based regression techniques based on polychotomous response variables are used. These mathematical techniques will be discussed in detail in Chapter IV.

H. RELIABILITY AND VALIDITY

An important step in the development of any classification system is the establishment of reliability and validity. Before any system is fully implemented, some assurance of reliability and validity should be achieved.

Reliability is basically a measure of consistency -- can the same results be achieved if the test or measurement is repeated? Two primary measures of reliability are stability and equivalence. Stability, usually determined with a test-retest procedure, refers to the consistency of responses on repeated applications. Equivalence refers to degree of agreement of responses. This can be measured by comparing results of two different raters evaluating the same patient with the same instrument at the same time, or by comparing responses resulting from the application of two different instruments to the same patient at the same time. Coefficient of equivalence is most useful for determining reliability of an instrument [Ref. 15]. If one instrument is used by two or more raters to assess one patient at the same time, a measure of interrater reliability may be determined. Calculation of a statistic such as Kendall's Coefficient of

Concordance (W) would result in a measure of the degree of agreement among raters, ranging in value from zero (no agreement) to one (complete agreement) [Ref. 30]. A high degree of agreement would provide a strong indication that different raters using the same instrument at the same time on the same patient would place that patient in the same category. Other statistical techniques may be employed if different instruments are used to classify the same patient at the same time.

There is no such thing as the reliability of an instrument. A high coefficient of reliability may decrease over time as personnel, procedures, policy or composition of patient populations change. It is also possible for reliability to increase over time as users of the instrument become more familiar with it and more adept in its use. Reliability determination should be repeated at intervals to provide assurance that the instrument may still be used with confidence.

The validity of a test or instrument refers to the degree to which that instrument actually achieves the aim or purpose for which it is intended -- in this case, how well the instrument estimates the patient's requirement for nursing care time or effort. The most important types of validity with regard to patient classification systems are content validity and criterion-related validity [Ref. 15].

Content validity is evaluated by determining how well the content of the instrument samples the domain it is

intended to measure -- in this discussion, demand for nursing care. The determination is not data-based but relies instead on judgments of experts. A common procedure associated with patient classification systems is for a committee or panel of nurses to review the various components of the system to determine if they are indeed representative and appropriate.

Criterion-related validity, which includes both concurrent and predictive validity, is determined by comparing the results of the instrument with some independent criteria -- some other measure or observation of the same variable. Concurrent validity is established by relating results of one instrument with those of another used at the same time. This is difficult to accomplish since most classification systems are designed for a specific facility and may not be accurate in another setting.

Predictive validity is determined by relating results of classification obtained at one time with criterion measures obtained at a later time. For example, if the classification system in use employs average times for nursing care per patient category, then predictive validity could be determined by classifying a group of patients and then, with observation studies, verifying that the patients received the established average amount of care appropriate for their category.

As is the case with reliability determination, validation is not a one-time process. To ensure accuracy and usefulness

of a classification system, validity testing should be an ongoing procedure.

I. IMPLEMENTATION

Even if a classification system has been carefully designed, tested, revised and refined, it will be of little use if adequate planning for its implementation has not taken place prior to its introduction.

Ideally, the eventual users of the system have been involved in its development, either on a regular consultation basis or as active members of the development team or committee.

Several factors must be addressed in the planning process and in the ongoing evaluation procedures. The most important of these is inservice education, which should begin before the system is put into full use. Users should be familiarized with the reasons for patient classification and what benefits might accrue to them, the patients and the facility, as a result of accurate classification. The specific instrument should be reviewed, along with the instructions or guidelines that accompany it. A good understanding of the theory and uses of patient classification is helpful in avoiding problems resulting from "padding" of scores. Some users, in an attempt to justify more staff, may have a tendency to bias the scores or classifications to reflect a greater demand for nursing care than actually exists. Some facilities have attempted to avoid this problem by

instituting "blind" completion of the form or instrument. The nurse checks applicable indicators for each patient, after which the ward clerk or the supervisor makes the appropriate computations and, using established decision rules, categorizes the patients. Whatever the methodology, an ongoing inservice program to reinforce procedures, orient new personnel and adjust for changes in policy and procedure is an essential element of successful implementation.

The design of the instrument should be seriously considered and evaluated during the planning process. Acceptance is enhanced if the format is clear and easy to use and the accompanying instructions or guidelines concise and readily understandable. Adequate time and effort spent in this phase of planning can avoid problems and confusion later.

Prior to implementation, decisions should be made regarding who is to be responsible for completing the forms, how the forms are to be completed, and when.

If the information is to be used to determine trends or distributions within the patient population, it may be necessary to complete the classification form only once a day, reflecting requirements for care as they exist at the time of completion of the forms.

If the data collected are to be used for determining staffing for the following shift or shifts, the data recorded should reflect expected demands for care. For example, suppose Patient X has been in the operating room since 0630

and is expected to return to the ward at 1600. The charge nurse completes the classification form at 1400. Patient X's requirements for care from ward personnel have been nil during the day but will be significant during the evening and possibly the night shift. Depending upon how the information is to be used, the charge nurse provides information reflecting actual demand for care or expected demand. It is important that this distinction be recognized and understood by the users; if information is provided in an inconsistent manner, the usefulness of the classification system will be severely curtailed.

The individual responsible for completing the classification form will rely on information from patient records, the Kardex®, and direct observation. It is essential that these records, particularly the patient care plan, be completed and updated regularly. Timely recording of pertinent information is an aspect of patient care that is frequently lacking, both in quantity and quality. Ready access to information on patients' diagnoses, medically ordered treatments, procedures and medications, nursing diagnoses and plans for care is important in the accurate assessment of demand for nursing care.

Plans for periodic assessment of the reliability and validity of the instrument should be established, along with some provision for monitoring of quality of care. If the patient classification system is to be used in a staffing methodology, the effectiveness of that methodology can be

determined to a great degree by evaluating its effect on the patient. The quality of the care received by the patient is difficult to measure. However, tools have been developed and are available to assist in determining whether standards of care are being met [Ref. 22]. In addition, guidelines have been identified to enable facilities to define acceptable standards of care within that facility [Ref. 3].

Giovannetti warns that, whatever classification system is chosen, it is important to recognize that its "usefulness is highly contingent upon the precision of the method selected, the degree of implementation throughout the health care facility, and the level of understanding and acceptance by all hospital personnel" [Ref. 14, p. 11].

As patient classification systems are studied and refined, increasing numbers of health care personnel are recognizing the potential information available to them through the use of these systems. However, many factors must be considered before a patient classification system is chosen. Responsible health care personnel must be able to recognize what their needs and the needs of the institution are before any decision involving selection, development, or implementation of a classification system can be made. Without adequate time and effort expended in the consideration of all pertinent factors, the results will prove to be less than optimal.

III. REVIEW OF THE LITERATURE

This review of the literature is presented to identify and briefly describe only a few of the many patient classification systems developed. The specific studies included were chosen to represent a sample of the variety of systems in use today, and this review is by no means exhaustive. Several of the systems have been chosen because they have served as the basis for the development of additional classification systems.

The majority of the work presented in this chapter has been undertaken in conjunction with the development of a specific staffing methodology. As the primary focus of this paper is patient classification systems, no attempt will be made to describe in detail any concomitant staffing methodology.

Most of the studies presented were developed for use with medical/surgical patients. Although additional work has been done in the areas of pediatrics [Ref. 26], long-term care [Ref. 5], psychiatry [Ref. 14] and public health [Ref. 29], they will not be discussed here. Additional information and references may be found in the surveys reported by Aydelotte [Ref. 2] and Giovannetti [Ref. 14].

A. ARMY [Ref. 7]

Some of the earliest work in the area of patient classification was begun in 1951 by the Army Medical Service in

cooperation with the Hospital Methods Improvement Branch, Medical Plans and Operations Division, Office of the Surgeon General. In an effort to define nursing needs of patients, it was determined that the factors most influencing patient care were (1) nursing procedural requirements, (2) physical restriction, (3) instructional needs, and (4) emotional needs. Over the course of the study, patient care categories numbered from three to nine; a four-category system was eventually determined to be most useful. These categories of nursing care needs were identified as intensive, moderate, minimal, and no nursing care.

Because no methodology or format is included in the report, this study is of more historical significance than practical use. It is interesting to note, however, that the parameters identified included not only physiological indicators of requirements but also psychological and instructional factors as well.

B. CONNOR [Ref. 9]

As part of an extensive study conducted at The Johns Hopkins University, Connor developed a patient classification system which has been widely recognized and has served as the basis for many subsequent studies of classification and staffing.

Direct care delivered to patients was measured through the use of continual observation techniques. The average nursing care times required by patients were then calculated.

Connor determined that the amount of care required varied with the self-sufficiency of the patient and that patients could be identified and classified as self-care, intermediate-care, and total-care patients. He then developed a classification scheme based on specific elements of nursing care. A simple check list of indicators was formulated and compared against a set of decision rules. The presence or absence of indicators, or specific combinations of indicators, determined to which class the patient was assigned. This information, when combined with other measurements of workload, was utilized in subsequent staffing studies.

The procedure and format of this classification system are simple and straightforward and require minimal time for completion. The classification system is more objective than its predecessors in that it allows little room for individual interpretation by raters. The main criticism of Connor's work has focused on the representativeness of the selected indicators. These indicators, based on such factors as mobility, consciousness, adequate vision and isolation, are physiological parameters and appear not to account for emotional or instructional needs. Although this may represent a major limitation, the methodology itself has been utilized in the development of many other classification systems.

C. CASH [Ref. 12]

This system, developed by the Commission for Administrative Services in Hospitals (CASH), has been revised several times since its introduction, and several facilities have reported implementation of systems modeled after the CASH system.

In the most recent revision (as described by Giovannetti [Ref. 14]), 12 main areas of care are identified, including eating, grooming and cleanliness, respiratory aids, teaching, emotional support, treatments and medication. In this design, four "ranges" are identified under each main area of care, describing the extent of intervention required by the nursing staff. An instruction sheet identifies the limits of each range within each area, and a worksheet is completed using this as a guide. The worksheet includes 12 columns corresponding to the main areas of care, and under each column are four numerical figures. These figures are point values representing standard times and correspond to the four ranges described earlier. For each patient, the point value representing the appropriate range within each care area is circled, and the circled values are summed to arrive at a coefficient for direct care. Other coefficients are determined for "constant" activity, and total point values are converted to time figures. From this calculation, staffing decisions are made.

There are several disadvantages inherent in the use of this system. First, the basis for workload estimation is standard time, which must be calculated individually for

each facility. The acceptance by health care professionals of the use of standard times is not high. As it has been presented, this system is useful only in conjunction with a specific staffing methodology. And finally, the detailed instruction sheet and worksheet appear cluttered and confusing, which could be a serious hindrance to the acceptance and accurate completion of the instrument.

D. MAINGUY, SMITH AND TRUITT [Ref. 11]

A study sponsored by the Department of National Health and Welfare, Ottawa, Ontario, was conducted in 1970 by Mainguy, Smith, Truitt and Giovannetti. The authors developed and refined a five-class prototype evaluation and tested it extensively for reliability and validity.

Validity of the instrument was tested by comparing results of other tools. Reliability was tested among categories of nursing personnel within a hospital and was also tested among hospitals. Exact agreement among nurses was determined to average 63.1%, but when agreement was defined as ± one category, average agreement among nurses was 98.2% [Ref. 11, p. 75].

The instrument identifies five patient categories and includes brief descriptions of patients who would belong in each category. Difficulty encountered in classification of patients with this instrument may be ascribed to the subjective approach, to the possible overlapping of classes that could occur with a five-class system, or to a combination of these factors.

E. MEDICUS CORPORATION [Ref. 25]

A factor evaluation classification system has been developed by Medicus Corporation in conjunction with Rush Presbyterian-St. Luke's Medical Center in Chicago. This system divides patients into four categories based on 32 indicators representing physiological, psycho-social and instructional needs. Applicable indicators are checked and the associated point values summed for each patient. (These point values may be representative of average care times, but this is not the case in all variations of this system.) Precise definitions are provided for each indicator, and a general description of patients in each category is given.

The definitions of the indicators are well-written and decrease the opportunity for individual interpretation by raters. The main advantage of this system is its flexibility, and it has served as the basis for several staffing methodologies. Personnel Allocation and Scheduling System (PASS) [Ref. 21], Nursing Management, Budgeting and Reporting System (NUMBRS) [Ref. 13], and the assignment element difficulty system reported by Norby [Ref. 25] all utilize a variation of this system.

F. NAVY [Ref. 23].

At the present time, a project is being carried out by the Research Division of the Naval School of Health Sciences, National Naval Medical Center to study the feasibility of

developing a staffing methodology for use in Navy hospitals based on assignment element difficulty. As part of this project, a patient classification system based on the Medicus design has been developed, tested and revised.

Indicators were reviewed by a panel of nurses for representativeness and revised to include a total of 34. Weights were determined for each indicator by utilizing three techniques based on Q-sort procedures, and each set of weights was tested for reliability with similar acceptable results. Additionally, a scaling technique based on the Constant Sum-Paired Comparisons method was tested. Use of this technique resulted in slightly increased reliability.

One of the major drawbacks of a factor evaluation design is the specificity of numerical weights or coefficients of the indicators. To be of value in a facility other than the development and testing site, extensive (and expensive) time measurement studies are usually required. Since this variation of the Medicus format was developed for use in a staffing methodology not based on time, it contains decided advantages. This is particularly true in light of the personnel structure unique to organizations such as the Navy. Both civilian and naval hospitals experience a certain degree of personnel turnover. However, the personnel structure in the Navy is centrally controlled and personnel rotate among various facilities, all of which function under similar organizational structure and follow generally similar policies

and procedures. This is seldom the case with civilian institutions.

At present, patient classification systems are in use only at some naval hospitals, and the instrument used varies from facility to facility. It would appear to be worthwhile to identify one classification system that could be easily adapted for use in several, if not all, naval hospitals. Use of such a system could allow recognition of the unique characteristics of each facility (medical services available, physical structure, etc.) while establishing greater consistency among all facilities in general. This standardization, by establishing a consistent means by which to measure requirements for nursing care, could prove beneficial to nursing personnel, hospital administrators and facility and manpower planners alike.

The patient classification system developed by Medicus was adapted for use in a Navy facility by members of the Research Division, NSHS. The testing and refinement of the instrument took place at two Navy facilities located on the East Coast. In light of the advantages of establishing a standard instrument throughout the Navy Medical Department, it was considered appropriate to test the reliability and validity of this instrument at an additional Navy facility. For this reason, the following research was conducted at a Naval Regional Medical Center on the West Coast.

IV. METHODOLOGY

A. OVERVIEW

The bulk of the methodology employed in this research was based on the work described by Montgomery of the Research Division, Naval School for Health Sciences (NSHS) [Ref. 23].

Contact was made with the Nursing Service of a Naval Regional Medical Center, where a special committee was conducting an independent search for an acceptable patient classification system. This committee, composed of five active-duty registered nurses and one civilian R.N., accepted the proposal to participate in the testing of the classification system developed by NSHS.

The format of the classification system was described and explained to the committee. The committee members reviewed the categories, indicators and definitions. The four-category classification format was accepted along with the associated descriptions. The categories and descriptions are included in Appendix A.

Data collection was then begun. Patient profiles were collected from four medical/surgical wards. These profiles included information from the nursing care plan found in the Kardex® along with additional information collected from patient records and the ward staff.

A total of eight nurses were instructed on the purpose of patient classification, given printed description of the patient categories, and asked to classify patients into

one of the four categories. Due to constraints on time and resources, not all nurses received copies of all patient profiles. However, each patient was classified by at least five nurses. Where discrepancies in classification occurred, the appropriate category was determined by consensus. Data collection was terminated when a total of 50 patients had been classified in this manner. These classifications, based on consensus nursing judgment, were used as criteria for testing reliability and validity of other instruments.

With the first phase of data collection completed, a list of indicators was compiled. The committee reviewed the list of indicators developed for the NSHS study. These indicators were found to be acceptable and representative of dependence upon nursing care with the addition of one indicator, "admission/discharge." These indicators are listed in Table I. Definitions of the indicators were also reviewed and, with the addition of the definition for "admission/discharge," were found to be clear and complete. These definitions are included in Appendix B.

Two nurses then determined which indicators applied to each patient based on information provided by the patient profile.

Various techniques were employed to determine weights for the 35 indicators. With each technique, the appropriate indicator weights were summed for each of the 50 patients. These totals were then compared to the classifications determined by consensus nursing judgment and boundaries for each

TABLE I

Patient Classification Indicators

1. feeds self
2. needs assistance eating
3. must be fed
4. incontinent/diaphoretic
5. bathes self
6. needs assistance with bath
7. must be bathed
8. isolation (enteric)
9. isolation (respiratory or wound and skin)
10. isolation (strict)
11. ambulatory with assistance
12. up in chair only
13. immobile in bed
14. needs minor emotional support
15. needs major emotional support
16. has minor teaching needs
17. has major teaching needs
18. needs simple treatment
19. needs complex treatment
20. requires special medications
21. vital signs q2h
22. vital signs q1h
23. vital signs more frequently than q1h
24. sensory deficits
25. single IV
26. multiple IVs
27. hyperalimentation
28. single procedure
29. multiple procedures
30. single tube
31. multiple tubes
32. respiratory therapy
33. confused/disoriented
34. accompany off unit
35. admission/discharge

patient category were established to coincide with the greatest agreement possible.

Data collection was then resumed. Fifty additional patient profiles were compiled and each patient was classified by two groups of three nurses. Both groups assigned 42 of the 50 patients to identical categories; these 42 patients were used as the second sample.

Again, two nurses identified the indicators applicable to each patient in the second sample. The corresponding weights were summed and the totals compared to the boundaries established earlier.

Finally, each of the four procedures used for weighting of indicators and classification of patients was tested against a third set of patient profiles in an attempt to determine not only the reliability but also the "portability" of this classification system. The 31 patient profiles used in this phase were collected at another Navy hospital, not at the test site. If the classification system could produce satisfactory results when used with patients hospitalized at another facility, it could be argued that the system is flexible enough to be transported from hospital to hospital.

B. RANKING PROCEDURES

Three of the four techniques used to determine indicator weights are based on the ordinal ranking of those indicators according to the degree of patient dependence on nursing

care associated with each. To determine this rank order, Q-sort procedures were employed [Ref. 34].

Eight nurses with medical/surgical nursing experience were asked to rank the indicators according to their perceptions of the amount of patient dependence on nursing care illustrated by each indicator. Each nurse was given a pack of 35 3x5 cards; on each card was written one of the indicators. The nurses were instructed to sort the cards into three piles, the first to include those indicators most indicative of patient dependence on nursing care, the third to include those least indicative of patient dependence on nursing care, with the middle pile to include those remaining. In order for the two extreme piles (containing those cards indicating "most" and "least" dependence on nursing care) to include an equal number of indicators, the inequality was absorbed by the middle pile. Hence the first sorting resulted in piles of 11, 13 and 11 cards. This procedure was repeated, taking each of the three initial piles and sorting the cards into three more piles, until all the indicators were individually ranked. The first sorting of 11, 13 and 11 was followed by subdivision of 3, 5, 3; 4, 5, 4; 3, 5, 3. The indicators in each of these small piles were ranked individually, the members of the first pile receiving ranks of 1, 2 and 3; those in the second pile receiving ranks of 4, 5, 6, 7 and 8; this continued until all indicators were ranked from 1 to 35.

The use of Q-sort procedures allows individuals to rank relatively large numbers of items readily by having the rater respond to the usually obvious distinction that exists between the highest and lowest members of a group. This allows the rater to avoid the frustration inherent in attempting to identify the finer distinctions usually occurring in the middle ranks. Although some nurses indicated a degree of frustration, most of the participants were able to complete the exercise without difficulty.

C. DETERMINATION OF INDICATOR WEIGHTS

Using the information obtained in the ranking phase of study, weights were then calculated for the 35 indicators. Three techniques based on rankings are reported and used by Montgomery [Ref. 23] and are repeated in this study. One additional technique, based on regression, was also investigated.

1. Average Rank/Ordinal Weight

Average ranks for each indicator were calculated from the results obtained in the ranking procedure. These results were listed ordinally and clusters of ranks were identified. The cluster of rankings associated with the least dependence on nursing care was assigned a weight of zero. The next cluster received a weight of one, the next a weight of two, and so on. Five clusters were identified; weights ranged from zero to four.

Use of this technique assumes that clusters of indicators occur at equal intervals along a scale of dependency.

2. Forced Normal Distribution

Individual rankings of all 35 indicators need not be determined to calculate weights using this methodology. A Q-sort procedure may be employed, but rather than resorting the indicators into progressively smaller piles, indicators are sorted into groups representing a normal distribution. In the case of 35 indicators, these piles, representing highest to lowest dependency, would contain 2, 4, 5, 13, 5, 4, and 2 indicators, respectively. The data resulting from this technique could be easily generated from the ranking procedure described in Section B of this chapter; therefore the sorting exercise was not repeated. Average ranks were listed in order of magnitude; the two indicators representing least dependency were assigned a weight of zero, the next four indicators assigned a weight of one, the next five given a weight of two, and so on, with the last two indicators assigned a weight of six.

Assigning weights to indicators according to a forced normal distribution avoids the difficulty inherent in determining individual ranks for large numbers of items. It assumes, however, that the indicators chosen are "representative of a normally distributed population of all possible indicators" [Ref. 23, p. 10].

3. Normal z-scores

Individual weights can be determined utilizing another technique which assumes a normal distribution of indicators. The assignment of a z-score to each indicator rather than ordinal weights to groups of indicators is intended to provide a more precise measurement and therefore a finer differentiation.

To determine z-scores for 35 indicators, the area under the standard normal curve was divided into 35 equal areas. The midpoints of the intervals which divided the area in this manner were then determined. These calculations, combined with the indicator rankings obtained earlier, provided the basis for determining indicator weights.

Replicating the procedure followed by Montgomery, the lowest and highest rank for each indicator was ignored. The z-scores corresponding to each of the remaining six ranks were summed. This procedure resulted in a "sum of z-scores" total for each indicator. (The sum could have been divided by six, resulting in an "average z-score.) This set of scores was then adjusted to eliminate negative values, resulting in a set of weights ranging from zero to 20.

4. Regression Model

One additional technique was employed to determine indicator weights and patient categories. The model used was adapted by Cavaiola [Ref. 5] from a methodology developed by Walker and Duncan [Ref. 33]. Although initially developed to classify patients in a three- rather than four-category

system, the model was considered appropriate for use in this study since no Class IV patients had been identified in the patient profiles collected.

This methodology estimates the probability of the occurrence of an event (a patient belonging to a particular category) as a function of numerous independent variables (patient classification indicators). With this model, regression of the independent variables on a logistic function representing a trichotomous response variable is undertaken. A logistic function is used because it more accurately represents the assumed discontinuity of the underlying distribution; a patient is either a member of a particular class, or he is not. Figure 1 displays an illustrative sigmoid curve with asymptotes at zero and one.

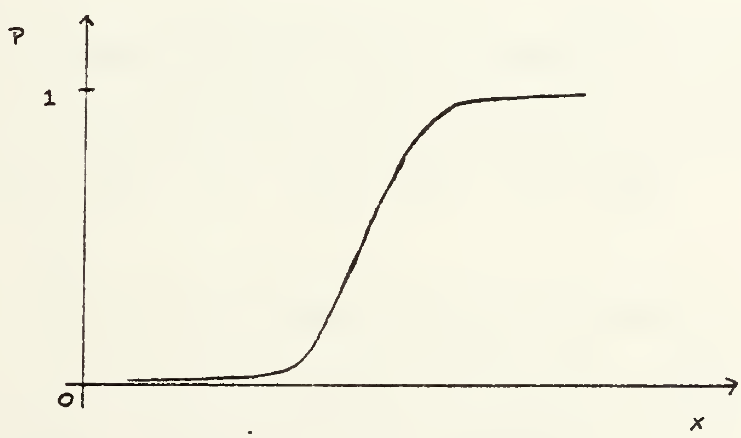

Figure I

Logistic Function

The logistic function is given by

$$P = (1 + e^{-\underline{x}'\underline{\beta}})^{-1}$$

where $\underline{x}$ is the vector of independent variable (patient classification indicators) and $\underline{\beta}$ is the vector of weighting coefficients to be estimated.

Following the development presented by Walker and Duncan and Cavaiola, the method attempts to fit two functions simultaneously:

$$p_1 = (1 + \exp(-\alpha_1 - \underline{x}'\underline{\beta}))^{-1}$$

$$p_1 + p_2 = (1 + \exp(-\alpha_2 - \underline{x}'\underline{\beta}))^{-1}$$

where p_1 is the fitted probability of being in Class 1 and $p_1 + p_2$ is the fitted probability of being in either Class 1 or Class 2. Obviously, $p_2 = (p_1 + p_2) - p_1$ and $p_3 = 1 - (p_1 + p_2)$.

After obtaining estimates of α_1, α_2, and $\underline{\beta}$, an individual patient's classification indicators can be applied to the above equations to provide the probability of belonging to each class. The operational classificational rule is to place the patient in that class for which the probability is maximum.

The first and second sets of patient profiles were combined to provide a total sample of 92 patients. This sample was then used to determine indicator coefficients.

The initial list of 35 indicators was condensed as illustrated in Table II. The indicator "respiratory therapy" was deleted because it was found not to be applicable to any of the patients in the study. A respiratory therapy department existed at the test facility and nursing service personnel were not responsible for providing this aspect of patient care. As this indicator did not represent patient demand for nursing care, it was not included as a variable.

The indicators "procedures" and "incontinent/ diaphoretic" were eventually deleted because they failed to converge after repeated iterations.

Once the coefficients had been determined, the model then classified the 92 patients, and the results of this classification procedure were compared with the initial classifications determined by consensus nursing judgment.

D. REMARKS ON MEASUREMENT

The first three weighting techniques described -- average rank/ordinal weight, forced normal distribution and normal z-scores -- share a common measurement problem. All three are based on the ranking of indicators. This ranking results in a scale which is ordinal in nature or, at best, interval.

With ordinal scale measurement, it can be said that one item possesses more or less of a specific attribute or factor

TABLE II

Condensed List of Patient Classification

Indicators Used with Regression Model

1. Eating
   - 0 feeds self
   - 1 needs assistance
   - 2 must be fed

2. Bathing
   - 0 bathes self
   - 1 needs assistance
   - 2 must be bathed

3. Isolation
   - 0 N/A
   - 1 CDC I
   - 2 CDC II
   - 3 CDC III

4. Mobility
   - 0 no restrictions
   - 1 ambulatory with assistance
   - 2 up in chair only
   - 3 immobile in bed

5. Emotional support needs
   - 0 N/A
   - 1 minor
   - 2 major

6. Teaching needs
   - 0 none
   - 1 minor
   - 2 major

7. Treatments
   - 0 none
   - 1 simple
   - 2 complex

8. Vital signs
   - 0 less often than q2h
   - 1 q2h
   - 2 q1h
   - 3 more often than q1h

9. IV's
   - 0 none
   - 1 single IV
   - 2 multiple IV
   - 3 hyperalimentation

10. Procedures
   - 0 none
   - 1 single
   - 2 multiple

11. Tubes
   - 0 none
   - 1 single
   - 2 multiple

12. Incontinent/Diaphoretic
   - 0 no
   - 1 yes

13. Requires special meds
   - 0 no
   - 1 yes

14. Sensory Deficits
   - 0 no
   - 1 yes

15. Confused/Disoriented
   - 0 no
   - 1 yes

16. Accompany off unit
   - 0 no
   - 1 yes

17. Admission/Discharge
   - 0 no
   - 1 yes

than another item (e.g., Indicator x represents more dependence on nursing care than Indicator y), but how much more is not known. If Indicators w, x, y and z are ranked according to the amount of dependence on nursing care they represent, the following may result:

$$w > x > y > z .$$

From this ranking, it is known that w represents more patient dependence than x or y or z, that x represents more dependence than y or z, but less than w, etc. But it is not known whether the difference in amount of patient dependency between w and x is the same as the difference between x and y or y and z.

If this difference (or distance) were known, the scale would be interval rather than ordinal. Even if the existence of an interval scale were assumed for convenience, measurement problems still exist. The distance between any two items on an interval scale is known, but no true zero point can be identified on the scale. A zero point may be chosen, but this represents only an arbitrary decision. For example, suppose the indicator "feeds self" is determined to represent no dependence on nursing care and is therefore assigned a weight of zero. Is this correct? Perhaps the patient's ability to feed himself represents independence and, on a scale of dependency, should be assigned a negative weight. This lack of a true zero presents additional problems when

values on an interval scale are summed as is the case with indicator weights. Unless the same number of values is summed for each patient, the results may be misleading.

Techniques have been developed to convert measurements made on an ordinal scale to an interval or ratio scale. One of the more well known is the Constant Sum-Paired Comparison method [Ref. 32]. With this technique, each item (in this case, indicator) to be scaled is paired with every other indicator to be scaled. Judges or experts (nurses) are asked to consider each pair and divide a total of 100 points between the two indicators. The number of points each member of the pair receives is based on the amount of the attribute to be scaled (dependence on nursing care) each member of the pair possesses in relation to the other. A series of mathematical computations is then performed with the data, resulting in the development of a ratio scale.

Although mathematically more sound that the techniques previously discussed, the Constant Sum-Paired Comparison method has several serious disadvantages. The first is the sheer magnitude of the number of comparisons required. For example, if this technique were used with 35 indicators, it would require that each nurse consider a total of 595 pairs of indicators, an obviously overwhelming task.

The second major disadvantage is the complexity of calculations required. This can be alleviated by the use of a computer, but this in itself might constitute a disadvantage for some.

An adaptation of the Constant Sum-Paired Comparison method, dubbed CS Hybrid, was utilized by Montgomery in the NSHS project [Ref. 23]. Use of the CS Hybrid method reduced the volume of required comparisons from 595 to 105. Due to limitations of time and resources, the CS Hybrid method was not included in this research study, although preliminary results warrant further investigation.

V. DATA PRESENTATION

A. RANKINGS

The results of the Q-sort procedure used to rank the 35 indicators are displayed in Table III. The indicator perceived to be most indicative of patient dependence on nursing care was ranked 1; the indicator least illustrative of patient dependence was ranked 35. As a test of interrater reliability, Kendall's Coefficient of Concordance (W) was computed [Ref. 30, p. 229]. This calculation resulted in a W of .806, highly significant at $p < .001$. Although this does not verify that the resultant ratings are "correct" with respect to the specified criterion, it does indicate that the eight nurses employed the same standards in their judgments.

B. INDICATOR WEIGHTS

1. Average Rank/Ordinal Weight

Table IV shows the results of average rank determination, with the indicators listed from lowest to highest with regard to associated dependence on nursing care. They are presented in the clusters which were identified in this study. Since the indicators in the first cluster ("feeds self" and "bathes self") were determined to be indicative of no dependence on nursing care, they were assigned a weight of zero. The remaining clusters were assigned weights from one through four.

TABLE III

Rankings of Patient Classification Indicators

Indicator Number*	Nurses 1	2	3	4	5	6	7	8
1	35	35	34	33	35	34	34	35
2	24	18	18	29	24	20	20	28
3	11	16	12	14	4	16	15	22
4	10	1	20	8	13	14	7	12
5	34	34	35	34	34	33	35	34
6	23	19	19	23	32	23	25	19
7	8	17	6	15	5	12	16	11
8	22	28	31	19	19	26	32	26
9	20	24	15	18	20	10	17	15
10	12	5	2	17	18	15	9	2
11	25	27	17	31	33	24	23	33
12	14	15	30	20	17	22	22	18
13	7	6	1	1	1	13	8	4
14	26	22	26	22	23	35	29	25
15	1	14	3	10	9	9	5	3
16	27	23	25	32	22	32	26	24
17	2	13	16	11	10	8	4	9
18	29	31	23	26	29	29	30	30
19	4	11	7	2	6	1	2	1
20	19	20	9	13	12	17	13	16
21	21	7	29	16	30	28	14	20
22	16	4	22	12	15	21	3	14
23	13	3	11	9	7	4	1	7
24	17	12	13	25	16	11	21	13
25	30	29	28	27	28	30	27	31
26	9	8	5	5	14	7	11	17
27	15	25	10	7	11	6	19	6
28	28	32	24	28	27	25	28	27
29	6	10	8	4	3	3	6	10
30	18	30	21	21	26	27	31	29
31	5	9	4	6	8	2	10	8
32	33	21	33	30	25	31	33	32
33	3	2	14	3	2	5	18	5
34	32	33	32	24	31	18	24	23
35	31	26	27	35	21	19	12	21

* Indicators listed by number in Table I.

Table IV

Clusters of Average Ranks of Indicators

Indicator Number	Average Rank	Assigned Weight	Indicator Number	Average Rank	Assigned Weight
1	34.4	0	9	17.4	3
5	34.1	0	24	16	3
			20	14.9	3
32	29.8	1	3	13.8	3
25	28.8	1	22	13.4	3
18	28.4	1	27	12.4	3
28	27.4	1	7	11.3	3
34	27.1	1	4	10.6	3
11	26.6	1	10	10	3
16	26.4	1	26	9.5	3
14	26	1	17	9.1	3
30	25.4	1			
8	25.4	1	23	6.9	4
35	24	1	15	6.8	4
6	22.9	1	33	6.5	4
2	22.6	1	31	6.5	4
			29	6.3	4
21	20.6	2	13	5.1	4
12	19.8	2	19	4.3	4

Appropriate indicator weights were summed for each of the 50 patients previously classified. Boundaries for each class were established to achieve the greatest agreement possible with consensus nursing judgment. The boundaries are listed in Table V. No patients were classified as belonging to Class IV; therefore the boundary between Classes III and IV represents only an estimate. Of the 50 patient profiles, 44 were classified correctly using this method. Testing this weighting technique against an additional sample of 42 patients, 35 were correctly classified. This resulted in correct classification for 75 of 92 patients, an overall agreement of 82%.

2. Forced Normal Distribution

When the weights which had been assigned according to a forced normal distribution of indicators were tested, the results were similar. Again, the indicators of "feeds self" and "bathes self" were assigned a weight of zero. The remaining indicators received weights from one through six as indicated in Table VI. The weights for applicable indicators for each of the 50 previously classified patients were summed and boundaries were established for each class (Table V). This resulted in correct classification of 43 patients. When tested with the second sample of 42 patient profiles, 33 patients were appropriately classified. An overall agreement of 83% was achieved with this weighting procedure.

TABLE V

Class Boundaries for Three Indicator Weighting Methods

Weighting Method	Patient Class I	II	III*	IV*
Average Rank/ Ordinal Weight	0-3	4-8	9-20	21-
Forced Normal Distribution	0-5	6-13	14-25	26-
Normal z-score	0-22	23-49	50-95	96-

*Boundary between Classes III and IV represents estimate.

TABLE VI

Summary of Data for Weighting of

Patient Classification Indicators

Indicator Number	Average Rank	Ordinal Weight	Forced Normal Dist'n Weight	Sum of z-scores	Adjusted z-score
1	34.4	0	0	-11.8	0
2	22.6	1	3	- 1.9	10
3	13.8	3	3	1.8	13
4	10.6	3	4	3.4	15
5	34.1	0	0	-10.8	0
6	22.9	1	3	- 1.8	10
7	11.3	3	3	3.1	14
8	25.4	1	3	- 3.5	8
9	17.4	3	3	0.2	12
10	10	3	4	4.3	16
11	26.6	1	2	- 4.7	7
12	19.8	2	3	- 0.4	11
13	5.1	4	6	8.4	20
14	26	1	2	- 3.3	8
15	6.8	4	5	6.1	17
16	26.4	1	2	- 3.9	8
17	9.1	3	4	4.3	16
18	28.4	1	1	- 5.3	6
19	4.3	4	6	8.8	20
20	14.9	3	3	1.3	13
21	20.6	2	3	- 1.6	10
22	13.4	3	3	2.2	14
23	6.9	4	4	5.8	17
24	16	3	3	1.2	13
25	28.8	1	1	- 5.2	6
26	9.5	3	4	4.4	16
27	12.4	3	3	3.2	15
28	27.4	1	1	- 4.3	7
29	6.3	4	5	6.2	17
30	25.4	1	2	- 3.7	8
31	6.5	4	5	5.7	17
32	29.8	1	1	- 6.9	5
33	6.5	4	5	7.2	18
34	27.1	1	2	- 5.0	7
35	24	1	3	- 3.0	9

3. Normal z-score

Table VI lists the indicators, the sums of the associated z-scores, and the adjusted z-scores. The adjusted z-scores were obtained by adding the constant of 11.8 to each "sum" score. This resulted in the lowest ranked indicator on the dependency scale being assigned a score of zero, and the remaining scores converted to positive numbers. The highest ranked indicator then had a score of 20.6. To calculate weights from these scores, the scores were adjusted once more by multiplying each by the constant .971 $(\frac{20}{20.6})$ and rounding to the nearest whole number, resulting in a set of weights ranging from zero to 20.

These weights were then tested with the same 50 patient profiles. The boundaries associated with this weighting technique are listed in Table V. Forty-two of the 50 patients were assigned to the appropriate class, as determined by consensus nursing judgment. When tested with the set of 42 patients, 32 were correctly classified, achieving an overall agreement of 80%.

Since z-scores represent a finer measurement distinction than the other methods described thus far, it might be expected that they would constitute a more sensitive tool for use with a classification system. However, this was not the case. Use of the z-score weighting technique produced results slightly lower than the other techniques discussed thus far.

4. Regression Model

All 92 patient profiles were used to determine coefficients and classifications with this model. Consistent classification was achieved with 85 patients, representing 92% agreement with consensus nursing judgment.

An analysis of variance (ANOVA) was performed; the results are displayed in Table VII. The F-test proved to be highly significant at $p < .001$.

A classification matrix was also constructed and is shown in Table VIII. In this matrix, "assigned class" refers to the class determined by the model; "appropriate class" refers to the class determined by consensus nursing judgment. The "recognition rate" represents the percentage of patients determined by consensus nursing judgment to belong to a specific class who were also assigned to that class by the model. The "prediction rate" gives the percentage of those patients determined by consensus nursing judgment to belong to a specific class, among all patients assigned to that class by the model. The overall recognition rate was 92%, while the overall prediction rate was 93%.

C. PERFORMANCE COMPARISON

All four methodologies were then employed to classify 31 profiles of patients hospitalized in another facility. Use of the techniques resulted in consistent classification of between 25 and 26 of the 31 patients. Summary results of classifications are listed in Table IX and a classification

TABLE VII

Analysis of Variance

Source	df	SS*	MS*	F**
Regression	14	13000.76	928.62	1322.07
Error	77	54.08	.70	
Total	91	13054.84		

* rounded

**significant at $p < .001$

TABLE VIII

Classification Matrix for Sample I (N = 92)

		Assigned Class				
		I	II	III	Total	Recognition Rate
Appropriate Class	I	34	2	0	36	.944
	II	2	34	1	37	.919
	III	0	2	17	19	.895
	Total	36	38	18	92	
	Prediction Rate	.944	.895	.944		

TABLE IX

Summary of Classification Agreement

for Four Indicator Weighting Methods

	Patient Sample I (N = 92)		Patient Sample II (N = 31)	
	Number	Percent	Number	Percent
Average Rank/ Ordinal Weight	75	82	26	84
Forced Normal Distribution	76	83	25	81
Normal z-score	74	80	26	84
Regression Model	85	92	26	84

matrix for the regression model results is given in Table X.

It can be seen from the data presented in Table IX that although minor discrepancies existed in classification consistency, results from each method were essentially similar. Considering all sets of patient profiles, exact agreement with consensus nursing judgment occurred for 80% to 92% of classifications made. Although underlying assumptions and methodology employed differed, excellent results were achieved with each technique.

TABLE X

Classification Matrix for Sample II (N = 31)

		Assigned Class				
		I	II	III	Total	Recognition Rate
Appropriate Class	I	13	1	0	14	.928
	II	2	7	2	11	.936
	III	0	0	6	6	1.000
	Total	15	8	8	31	
	Prediction Rate	.867	.875	.750		

VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

This study was undertaken in an attempt to identify a flexible patient classification system that could be used with confidence as a tool to assist in the determination of nursing care workload.

A patient classification system in use at one Naval Regional Medical Center was revised and tested at another naval facility. Indicators of patient dependence on nursing care were identified and four methods were used to determine indicator weights and patient classification. The results of each method were evaluated in comparison with consensus nursing judgment and determined to be essentially equivalent.

B. CONCLUSIONS

Classification of patients made with each of the weighting methods resulted in a high degree of agreement with consensus nursing judgment. Although the simpler techniques (Average Rank/Ordinal Weight, Forced Normal Distribution and Normal z-score) may violate strict mathematical measurement requirements, their use consistently resulted in reliable classifications. The regression model, although more sophisticated, produced essentially the same results. Because of the complexity of the model and resultant reliance on electronic data processing, it is recommended that one of the simple

weighting methods (e.g., Average Rank/Ordinal Weight) be employed in conjunction with the classification system.

On the basis of the overall results of the study, it would seem that the patient classification system employed can be readily adapted to recognize the unique needs and characteristics of a specific facility. The fact that this system is not initially based on time offers another distinct advantage. It possesses a great amount of flexibility not only in adaptation within a specific facility but also in application to a variety of staffing methodologies. With the addition of facility-specific data, it can be used with any number of time-based methods, as well as with a difficulty-based staffing model. These are certainly beneficial characteristics of any patient classification system intended for use in more than one facility.

C. RECOMMENDATIONS

In light of the results of this study, it is recommended that the patient classification system be implemented on the medical/surgical wards at the test facility on a trial basis, using the Average Rank/Ordinal Weight results to determine patient categories. Ongoing inservice education is essential to ensure accurate use of the instrument and to enhance user acceptance. The system should be reviewed and evaluated regularly to allow for adjustment of indicator weights, class boundaries and indicators themselves. These adjustments may be required as a result of changes in policy,

procedures, or patient population. Need for adjustments may also become evident as the staff becomes more familiar with the use of the classification and more adept in completion of the associated forms.

In order to further enhance acceptance by the users, several recommendations are made regarding collection of data. The instrument itself should be clear and easy to use. A simple check-list format, with patients listed along one edge of the form and indicators along the other, can be completed easily and requires minimal time or effort. The format will be further improved if the indicators are listed in an order corresponding to that found in the care plan used as a reference. If summary data including the total number of patients in each class is included near a corner of the form, it will enable the supervisor or staffing co-ordinator to review a large number of forms easily.

Whatever format is used, the importance of adequate explanation and instruction cannot be overemphasized. Attention to these details will increase user acceptance and avoid inaccuracies in completion. Education, together with periodic review of the system itself, will determine the eventual worth of any patient classification system.

It must be remembered, however, that implementation of a patient classification system is not a final solution to the problem of determination and allocation of nursing resources. It is meant to be used as an aid in this decision-making process, whether as an integral component of

a specific staffing model or as an adjunct to the supervisor's experience and assessments.

Patient classification systems provide only part of the information required for sound staffing decisions. Continued study is required in workload determination, staffing requirements, proper mix of personnel and quality of care. To be effective, any approach to staffing must include consideration of short-term scheduling, appropriate allocation of staff, and system-wide manpower requirements.

APPENDIX A

Patient Category Descriptions for General Medical/Surgical Wards

I. Minimum Care - Patients in this category require little or no assistance with activities of daily living. They require a minimal amount of nursing care relative to medications, treatments and teaching needs.

A minimum care patient may have an IV, but it does not interfere with the ability of the patient to ambulate. Patients who are hospitalized for diagnostic studies, who are awaiting elective surgery, or who are in the final stages of convalescence are likely candidates for this category. Patients in traction should not be included in this category.

II. Intermediate Care - Patients in this category generally require assistance with or supervision of most activities of daily living. They require more than minimal care relative to their medications, treatments, teaching and emotional needs. They do not, however, require frequent skilled care and observation throughout the shift. Their nursing care needs, although significant, are generally intermittent in nature.

Patients who are recovering from surgery or special procedures, as well as certain chronically ill patients, are likely candidates for this category.

III. Complete Care - Patients in this category require frequent skilled nursing care throughout the shift. They require nursing to initiate, supervise or totally perform most activities of daily living and may require frequent and complex medications and treatments. They may also require significant amounts of teaching and emotional support.

Patients with residual damage from CVA, unconscious patients, confused and/or disoriented patients, as well as certain terminally ill patients, are likely candidates for this category.

IV. Intensive Care - Patients in this category require continuous skilled nursing care throughout the shift for the prevention of complications and may be in and out of control. Frequent re-evaluation is necessary so that immediate adjustment of therapy can be undertaken.

This group may include patients who require an artificial respirator, peritoneal dialysis, or continuous observation in life-threatening situations. These patients are candidates for the ICU. They will only rarely be found on a general medical/surgical ward.

APPENDIX B

Patient Classification Indicator Definitions

General Area	Indicator	Definition
Feeding	1. feeds self	1. Self-explanatory
	2. needs assistance eating	2. Refers to patients who require any assistance with feeding, such as opening salt and pepper, cutting meat, pouring milk, etc. Does not include simply bringing tray to patient.
	3. must be fed	3. Refers to patients who must be fed or require constant supervision while eating. Includes patients who require tube feedings.
Continence	4. incontinent/ diaphoretic	4. Refers to patients who are incontinent of urine or feces, patients with diaphoresis, vomiting, bleeding, or wound drainage requiring linen change or use of chux. Does not refer to patients whose urinary incontinence is controlled by Foley or external catheter.
Bathing	5. bathes self	5. Self-explanatory
	6. needs assistance with bath	6. Refers to patients who require any assistance with bath or shower but who do most of the bath themselves. Includes patients who must have bath water brought to them.

	7.	must be bathed	7.	Refers to patients who must be bathed completely by nursing personnel or who require constant supervision while bathing or showering.
Isolation	8.	isolation (enteric)	8.	Enteric precautions as defined in CDC guidelines.
	9.	isolation (respiratory or wound and skin)	9.	Respiratory precautions or wound and skin precautions as defined in CDC guidelines.
	10.	isolation (strict)	10.	Protective or strict isolation as defined in CDC guidelines.
Mobility Limitations	11.	ambulatory with assistance	11.	Ambulatory with crutches or in a wheelchair. Requires assistance in and out of bed and attention while ambulating.
	12.	up in chair only	12.	Able to move in bed and assist with lifting and turning. May not or cannot get out of bed, except to sit in chair.
	13.	immobile in bed	13.	Cannot move without assistance. Includes patients who are comatose, catatonic or quadraplegic.
Emotional Needs				The "emotional needs" indicators should not be included unless emotional needs are specifically addressed in the nursing care plan.
	14.	needs minor emotional support	14.	Refers to patients or families who require up to 15 minutes of emotional support throughout this shift.

Teaching Needs			The "teaching needs" indicators should not be included unless teaching needs are specifically addressed in the nursing care plan.
	16. has minor teaching needs	16.	Refers to patients or families who require up to 15 minutes of teaching time during this shift.
	17. has major teaching needs	17.	Refers to patients or families who require more than 15 minutes of teaching during this shift.
Treatments			Refers to treatments done by ward nursing personnel without the physician or special technician in attendance.
	18. needs simple treatments	18.	Refers to patients who require treatments that do not take longer than 15 minutes total time on this shift.
	19. needs complex treatments	19.	Refers to patients who require treatments that take more than 15 minutes total time on this shift.
Medications	20. requires special meds	20.	Refers to patients who require more than four different medications, or PRN medications more than two times this shift. Patients who require persuasion to take meds or assistance in taking meds (e.g., sitting up, holding glass, etc.) Patients who require evaluation of effects of medication during the administration,

				such as titration. Patients whose medications must be given over a specific time, such as within 15 minutes, not less than three minutes, etc. Patients whose medications require special equipment for administration. Experimental and chemotherapeutic drugs.
Vital signs				Refers to patients whose vital signs, neuro checks, peripheral pulses, etc. require monitoring, or who otherwise must be evaluated by nursing personnel with frequency of at least q2h.
	21.	vital signs q2h	21.	Refers to vital signs, checks, etc. with frequency of q2h.
	22.	vital signs q1h	22.	Refers to vital signs, checks, etc., with frequency of q1h.
	23.	vital signs more often than q1h	23.	Refers to vital signs, checks, etc. with frequency greater than q1h.
Sensory Deficits	24.	sensory deficit	24.	Refers to patients who are blind or nearly blind, deaf or nearly deaf or hard of hearing, have expressive or receptive aphasia, do not speak or understand English. Refers to patients who cannot express themselves verbally, including patients on voice rest. Includes patients with temporary blindness or temporary deafness due to patches or dressings.

Intravenous	25.	single IV	25. Refers to patients with one active IV injection site.
	26.	multiple IV's	26. Refers to patients with more than one active IV injection site.
	27.	hyperalimentation	27. Refers to patients receiving hyperalimentation, blood or blood components.
Procedures	28.	single procedure	28. Refers to patients who require preparation form ward nursing personnel for <u>one</u> special procedure <u>such</u> as lumbar puncture, thoracentesis, bronchoscopy, arteriogram, etc. <u>or</u> for surgery. <u>Also</u> refers to patients who require the presence of ward nursing personnel during a special procedure.
	29.	multiple procedures	29. Refers to patients who require preparation from ward nursing personnel for more than one of the above.
Tubes	30.	single tube	30. Refers to patients who have one tube. Does not include IV's.
	31.	multiple tubes	31. Refers to patients with more than one tube. Does not include IV's.
Respiratory Therapy	32.	respiratory therapy	32. Refers to patients who require O_2 therapy, heated aerosol, IPPB, chest P.T., etc., if done by or assisted by ward nursing personnel. Includes clapping, vibrations and postural drainage. Does not

				include "turn, cough and deep breathe" or use of blow bottles.
Mental Status	33.	confused/ disoriented	33.	Refers to patients who are unable to follow commands or care for themselves because of confusion, or who are disoriented to time and place. Does not refer to the unconscious patient.
Transport	34.	accompany off unit	34.	Refers to patients who must be accompanied off the unit by ward nursing personnel because patient's medical condition requires accompaniment by a member of the nursing staff. Does not refer to accompaniment which could as well be provided by non-nursing personnel.
Admission/ Discharge	35.	admission/ discharge	35.	Refers to patients who arrive on the ward during the shift or who are discharged or transferred from the ward during the shift.

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